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ALL-CERAMIC CROWNS

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INTRODUCTION

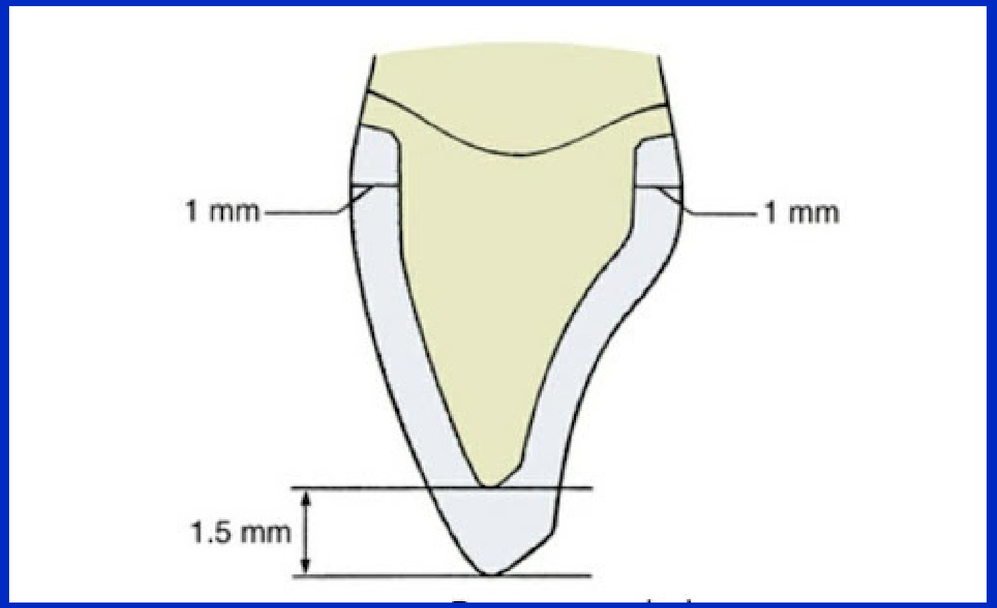
All-ceramic inlays, onlays, veneers, and crowns are some of the most esthetically pleasing prosthodontic restorations. Because there is no metal to block light transmission, they can resemble natural tooth structure better in terms of color and translucency than any other restorative option. Their chief disadvantage is their susceptibility to fracture, although this is lessened by using the resin-bonded technique.

The restorations may be fabricated in several ways. The technique (first developed more than 100 years ago) originally called for a platinum foil matrix to be intimately adapted to a die. This supported the porcelain during firing and prevented distortion. The foil was removed before cementation of the restoration.

Today, popular fabrication processes for restorations include hot-pressing and slip-casting.

COMPLETE CERAMIC CROWNS

- Should have reasonably uniform thickness circumferentially.
- For hot-pressed ceramic crown (e.max press or OPC, usually about 1.0 - 1.5mm thickness is needed to create esthetically pleasing restoration.
- Incisally, a greater ceramic thickness is helpful.



Advantages:

- Superior esthetics in comparison with metal-ceramic crowns
- Excellent translucency (similar to that of natural tooth structure)
- Good soft tissue response

Disadvantages:

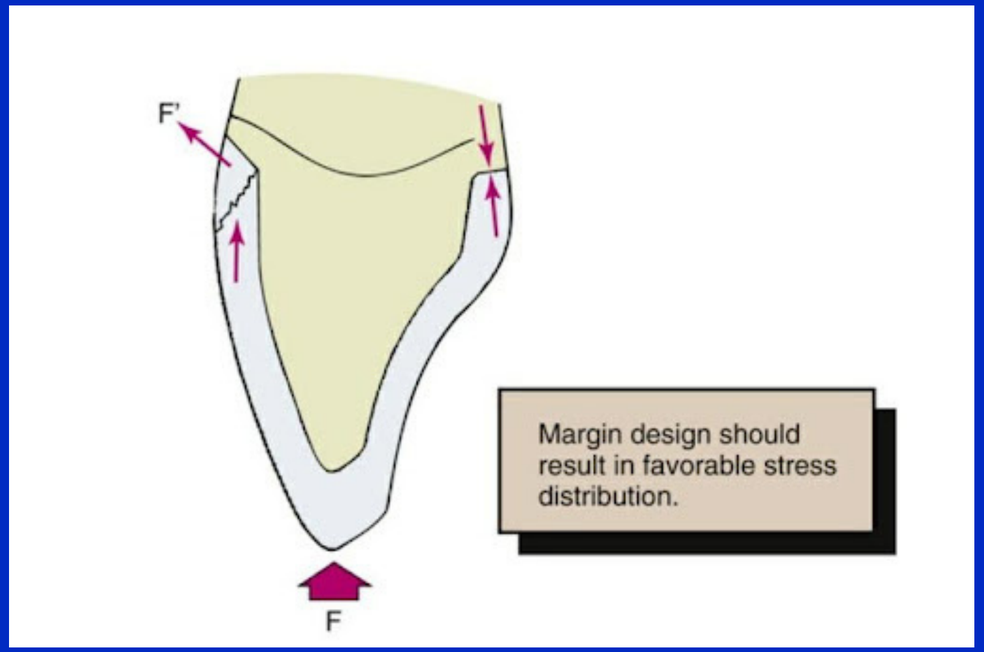
- Reduced strength of the restoration because of the absence of a reinforcing metal substructure
- The unforgiving nature of porcelain, if an inadequate tooth preparation goes uncorrected, can result in fracture

Indications

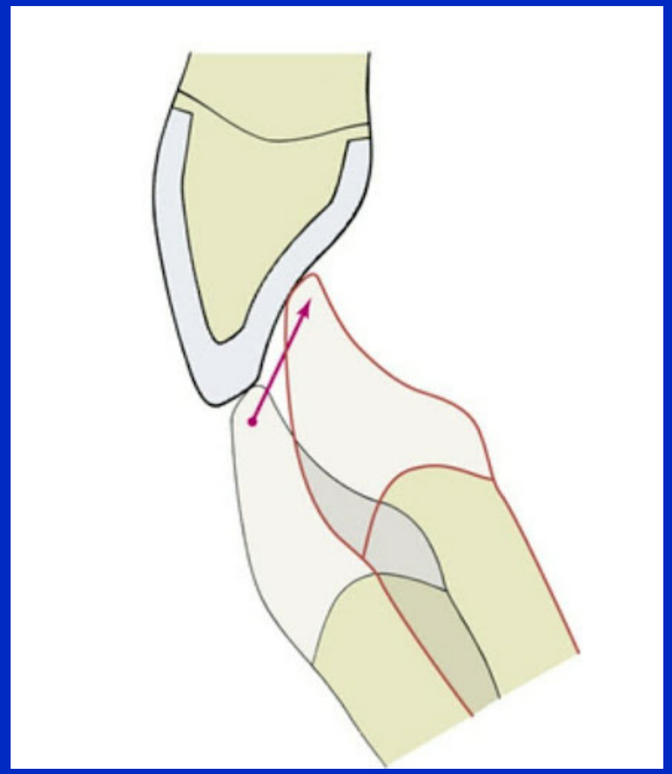
- In areas with high aesthetic requirement where a more conservative restoration will be adequate.

Contraindications

- Where a more conservative restoration can be used.
- Not indicated for molars because of increased occlusal load and reduced aesthetic demand.



(A sloping shoulder is not recommended for the all-ceramic crown. It does not support the porcelain. Incisal loading leads to tensile stresses near the margin if the forces are not reciprocated, which may cause brittle failure).



The design of the occlusion on an all-ceramic crown is crucial to avoid fracture. Centric contacts are best confined to the middle third of the lingual surface. Anterior guidance should be smooth and consistent with contact on the adjacent teeth. Leaving the restoration out of contact is not recommended. Future eruption may lead to new protrusive interferences, precipitating fracture.

CRITERIA	DESCRIPTIONS	CORRECT ANSWER
Finish Line	If the finish line even throughout?	Yes
	Lingual: Would you classify the finish line as Chamfer?	No
	Buccal: Would you classify the finish line as Shoulder?	Yes
	Facial: Depth of finish line (Axial Reduction)	1 mm
	Lingual: Depth of finish line (Axial Reduction)	1 mm
Margin	Is the margin supragingival?	Yes
	Is your margin parallel to the marginal gingiva?	Yes
Occlusal reduction	Is the occlusal surface anatomically reduced?	Yes
	Is the occlusal surface flat?	No
	Is the occlusal surface under-reduced?	No
Functional cusp bevel	Is there a bevel on the functional cusp?	Yes

CRITERIA	DESCRIPTIONS	CORRECT ANSWER
Occlusal Clearance	Is the occlusal clearance adequate?	2 mm
Taper	Facial View: How much is the taper of the crown?	6-12 degree
	Proximal View: How much is the taper of the crown?	6-12 degree
Proximal Clearance	Is proximal clearance present both mesially and distally?	Yes, 0.5-1mm
Path of insertion	Can you see a uniform outline around the tooth?/ Undercuts are absent?	Yes
Finish	Rounded angles/edges	Yes
	J-shaped margins	No
	Adjacent tooth damage	No
	Adjacent soft tissue damage	No
	Burn marks	No

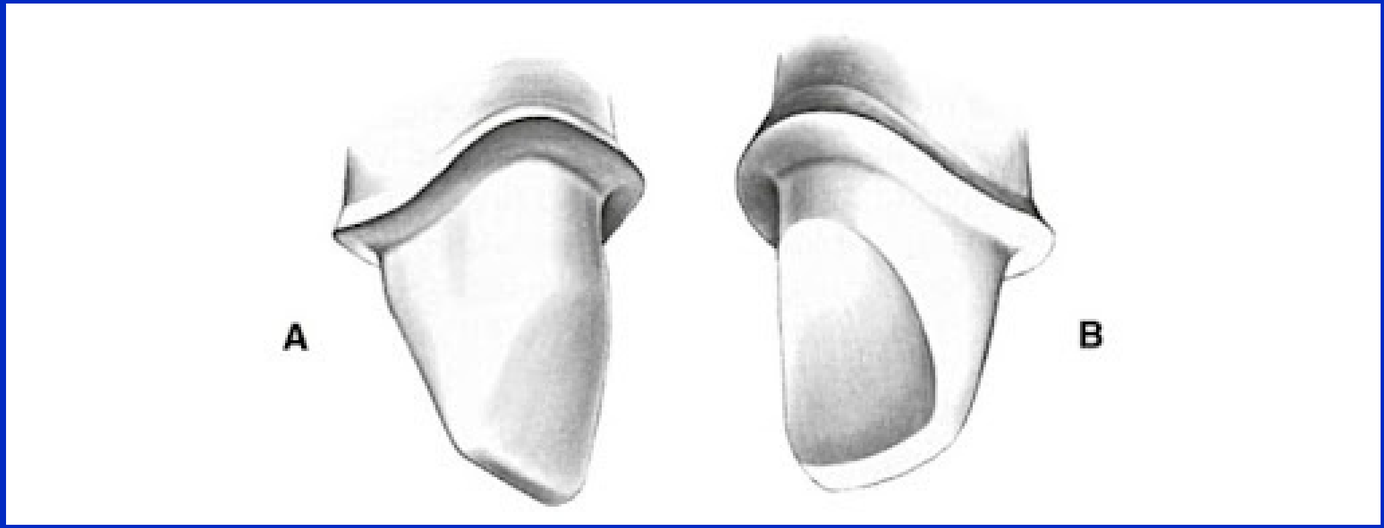
PREPARATION
STEP-BY-STEP PROCEDURE

ARMAMENTARIUM

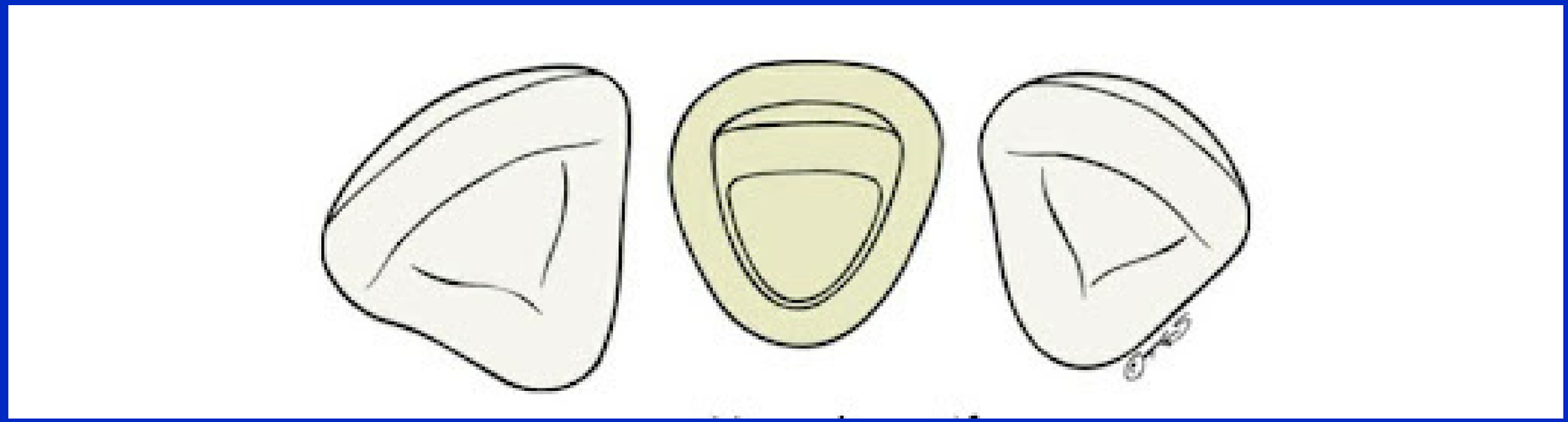
- Round-ended, tapered diamonds, regular and coarse grit (0.8mm)
- Square-ended, tapered diamond, regular grit (1.0mm), or end-cutting diamond Football-shaped diamond
- Fine grit finishing diamonds/carbides Mirror
- Periodontal probe
- Explorer
- Chisels and/or hatchets
- High- and low-speed handpieces

PROCEDURE

Preparation sequence is similar to that of metal-ceramic crown; the principal difference is the need for a 1-mm wide circumferential chamfer margin.



A. Labial view B. Lingual view
(Note the rounded internal line angles)



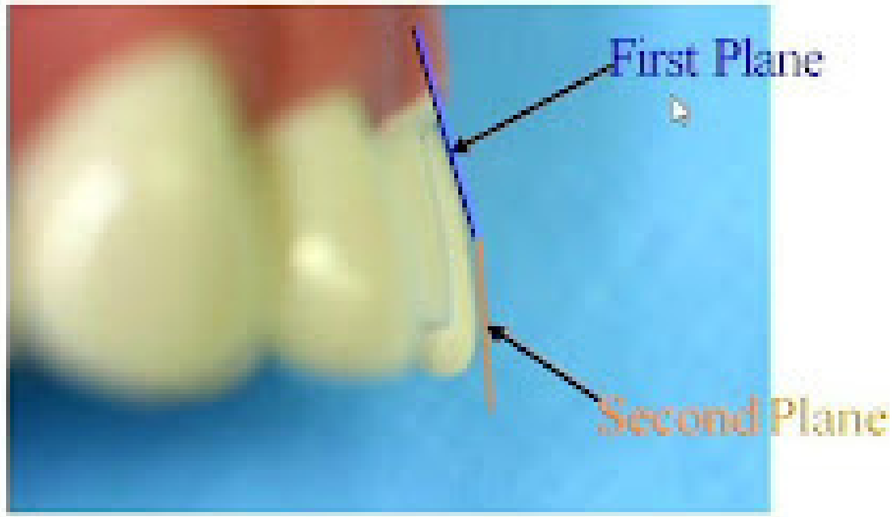
Note the uniform chamfer margin width of 1 mm on this all-ceramic preparation

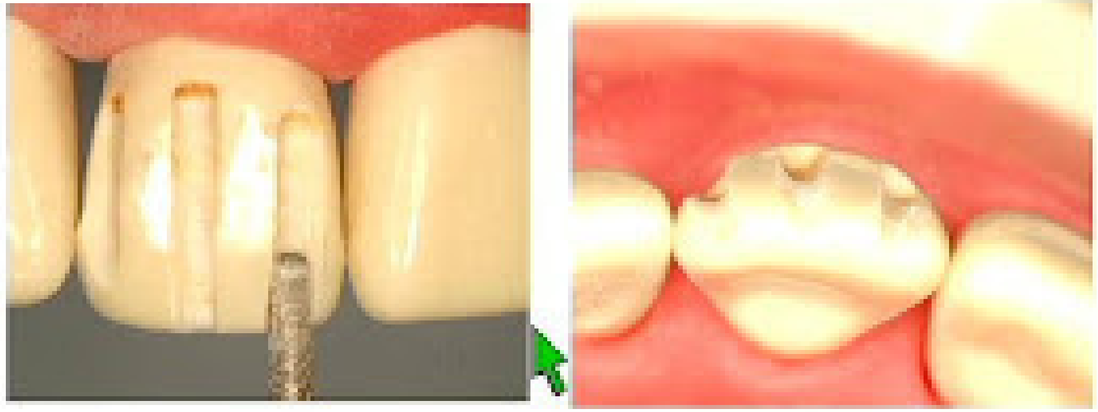
i) Incisal (occlusal) reduction -(Incisal reduction should provide 1.5 -2mm of clearance)

- Place two or three-depth grooves in the incisal edge.
- Initially, keeping them approximately 1.3mm deep to allow for additional loss of tooth structure during finishing.
- The grooves are oriented perpendicular to the long axis of the opposing tooth to provide adequate support for the porcelain crown.
- Complete the incisal reduction, reducing half the incisal edge at a time.
- Verify on completion that the desired clearance has been achieved.

ii) Facial reduction

- After placing depth grooves, reduce the labial/buccal surface and verify that clearance is adequate for 1 mm of porcelain thickness.
- One depth groove is placed in the middle of the facial wall
- One each in the mesiofacial and distofacial transitional line angles
- Reduction then performed with a cervical component parallel to the proposed path of placement
- An incisal component parallel to the original external facial contour of the tooth
- The depth of these grooves should be approximately 0.8mm
- Perform reduction & evaluate its adequacy.
- Accomplish the bulk reduction with the round-ended, tapered diamond.

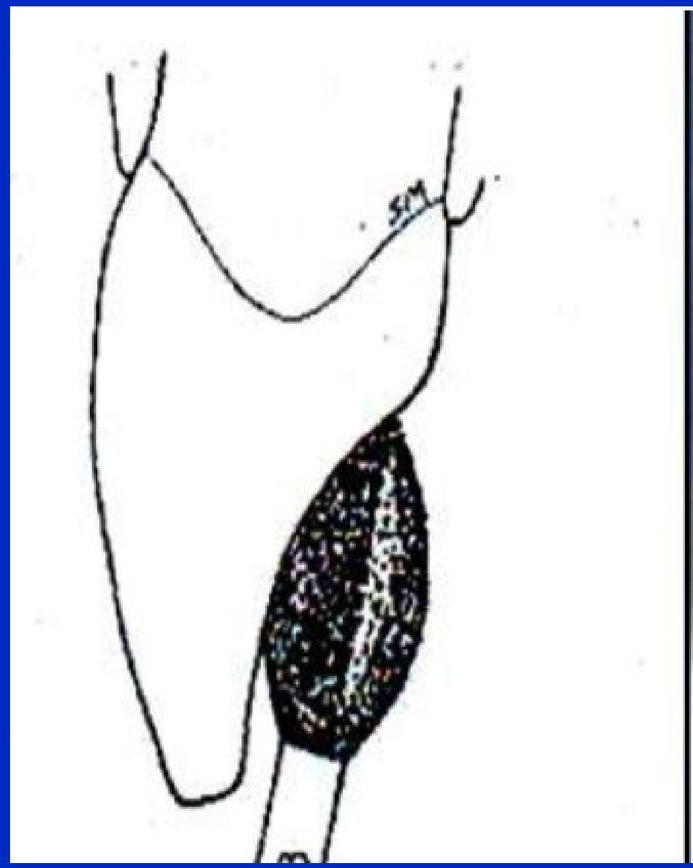


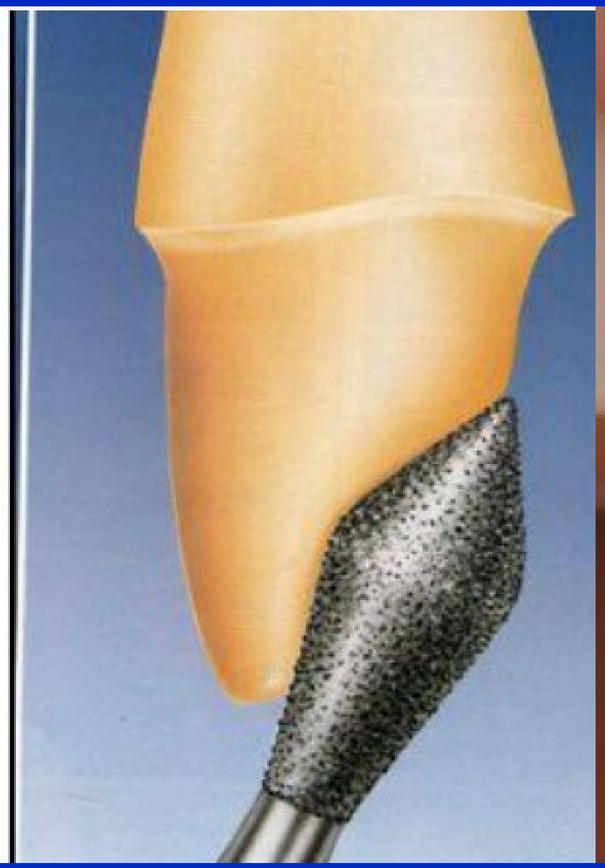


Axial reduction needs to be done in 2 planes

LINGUAL REDUCTION

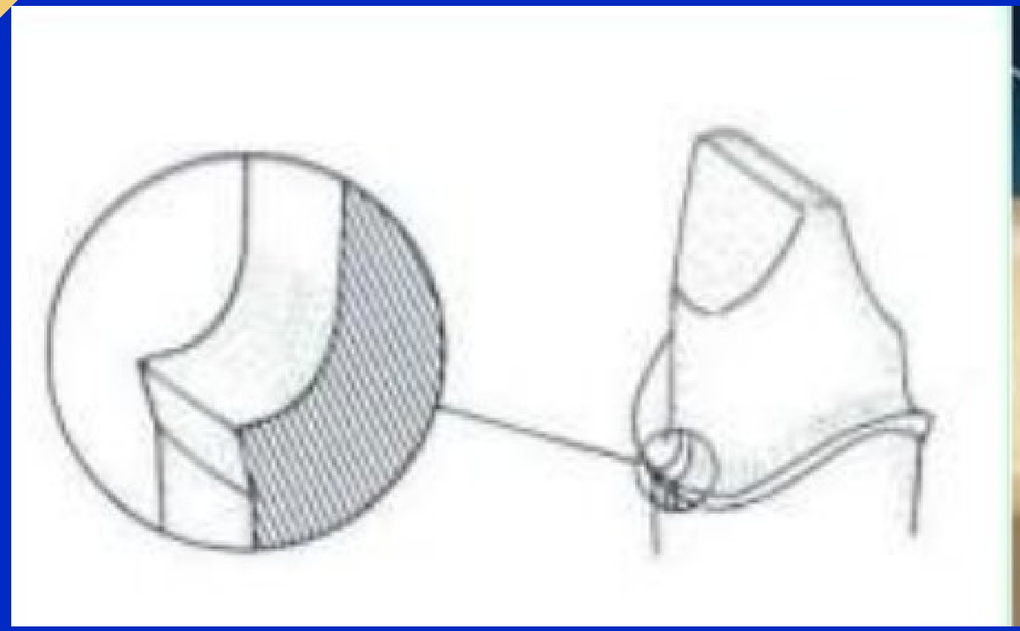
- Use the football-shaped diamond for lingual reduction after placing depth grooves approximately 0.8 mm deep.
- Perform lingual reduction until clearance in all mandibular excursive movement is 1 mm, to ensure adequate room for the porcelain in all load-bearing areas.
- Place a depth groove in the middle of the cingulum wall.
- Repeat the shoulder margin preparation, this time from the center of the cingulum wall into the proximal aspect, till the lingual shoulder margin meets the facial shoulder margin.
- This margin should follow the free gingival crest and should not extend too far subgingivally.

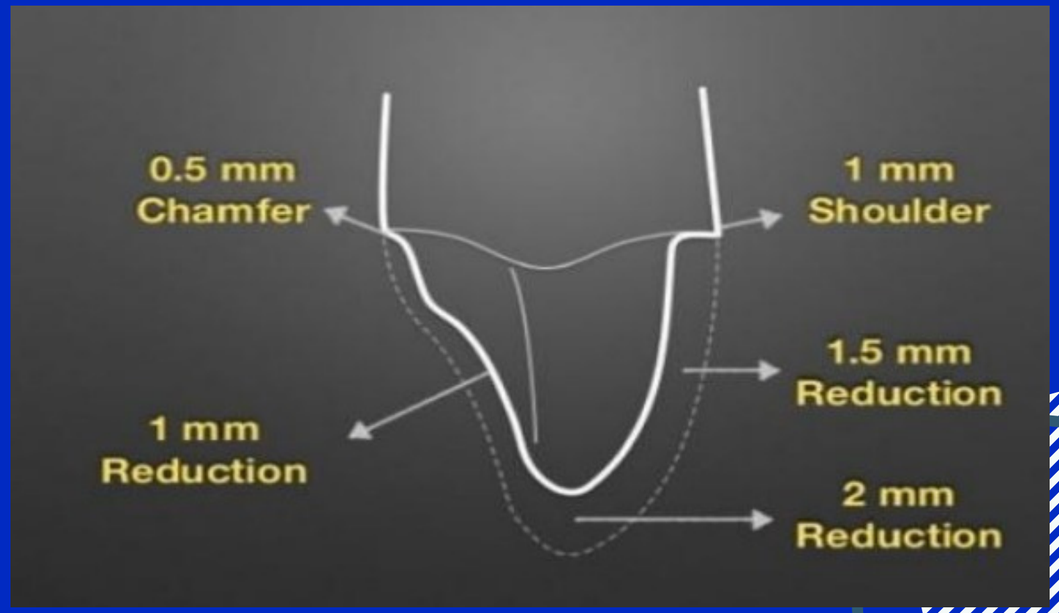




SHOULDER MARGIN PREPARATION

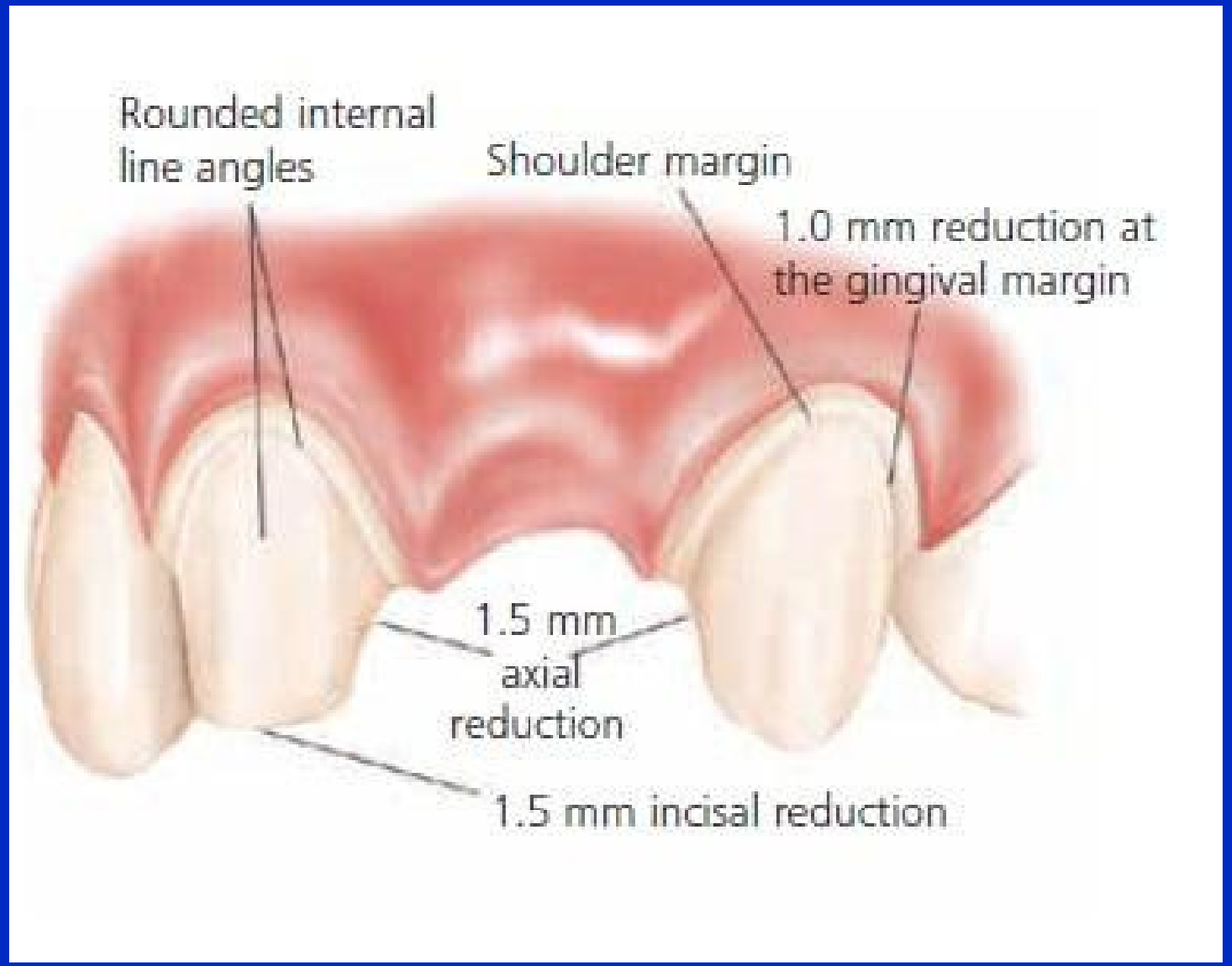
- A sloping shoulder margin results in unfavorable loading of the porcelain, with a greater likelihood of tensile failure through the ceramic.
- A 90° cavosurface angle is optimal;
- However, no residual unsupported enamel must be overlooked because it easily chips off.
- The completed margin should be 1mm wide, have a rounded internal line angle, be smooth, be continuous, and be free of any irregularities.




0.5 mm
Chamfer
1 mm
Shoulder
1.5 mm
Reduction
1 mm
Reduction
2 mm
Reduction

FINISHING

- Finish the prepared surfaces to a final smoothness.
- Round any remaining sharp line angles to prevent a wedging action, which can cause a fracture.
- Perform any additional margin refinement as needed, using either the diamond or a carbide rotary instrument of choice.


Rounded internal line angles
Shoulder margin
1.0 mm reduction at the gingival margin
1.5 mm axial reduction
1.5 mm incisal reduction

Indications	Contraindications	Advantages	Disadvantages
• High esthetic requirement • Considerable proximal caries • Incisal edge reasonably intact • Endodontically treated teeth with post and cores • Favourable distribution of occlusal load	• When superior strength is warranted and metal-ceramic crown is more appropriate • Extensive caries • Insufficient coronal tooth structure for support • Thin teeth faciolingually • Unfavourable distribution of occlusal load • Bruxism	• *Esthetically unsurpassed* • *Good tissue response even for subgingival margins* • *Slightly more conservative of facial wall than metal-ceramic restorations*	• Reduced strength in comparison with metal-ceramic crown • Proper preparation extremely crucial • Among least conservative preparations • Brittle nature of material • Can be used only as single restoration

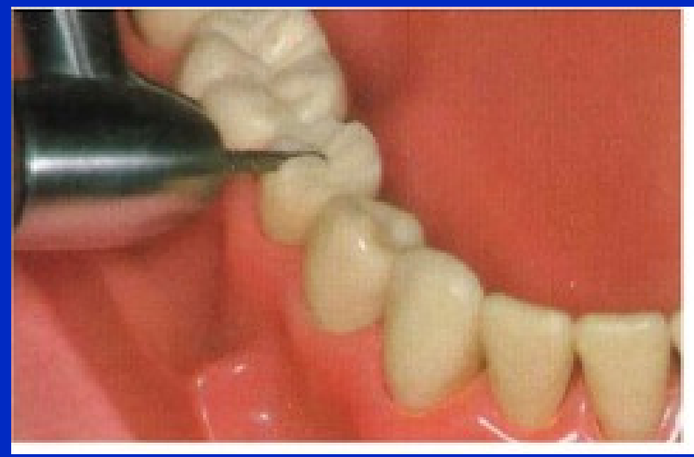
Preparation steps	Recommended Armamentarium	Criteria
Depth grooves for incisal reduction	Tapered Diamond	Approximately 1.3mm deep to allow for additional reduction during finishing; perpendicular to long axis of opposing tooth
Incisal reduction	Tapered Diamond	Clearance of 1.5mm; check excursions
Depth grooves for facial reduction	Tapered Diamond	Depth of 0.8mm needed for additional reduction during finishing
Labial reduction	Tapered Diamond crown preparation	Reduction of 1.2mm needed; two planes, as for metal-ceramic
Depth grooves and lingual reduction Depth grooves for cingulum reduction	Tapered and football-shaped diamonds Tapered diamond	Initial depth, 0.8mm; recreate concave configuration; do not maintain any convex configurations (stress) Parallel to cervical aspect of facial preparation; 1 mm of reduction; shoulder margin follows free gingival margin
Depth grooves and lingual reduction Depth grooves for cingulum reduction Lingual shoulder margin preparation Finishing	Square-ended diamond Fine-grit diamond or carbide	Rounded shoulder margin 1 mm wide; minimize “peaks and valleys”; 90-degree cavosurface angle All surfaces smooth and continuous; no unsupported enamel; 90-degree cavosurface angle

CROWN PREPARATION FOR PREMOLAR

- A combination of a facial and lingual index is made by adapting silicone putty to the facial, lingual, and occlusal surface of the posterior teeth.
- This will provide an accurate reference for both facial and lingual reduction.

Occlusal reduction

- Use large round end tapered diamond to place depth orientation grooves on the occlusal surface.
- The final occlusal preparation should be between 1.5mm - 2mm.
- Remove the remaining tooth structure between the grooves following inclined planes of the occlusal surface.



- Use the same round-ended tapered diamond to produce depth orientation grooves for the functional cusp bevel.
- Create the functional cusp bevel to ensure that the facial incline of the facial cusp will have the same porcelain thickness as the lingual incline.

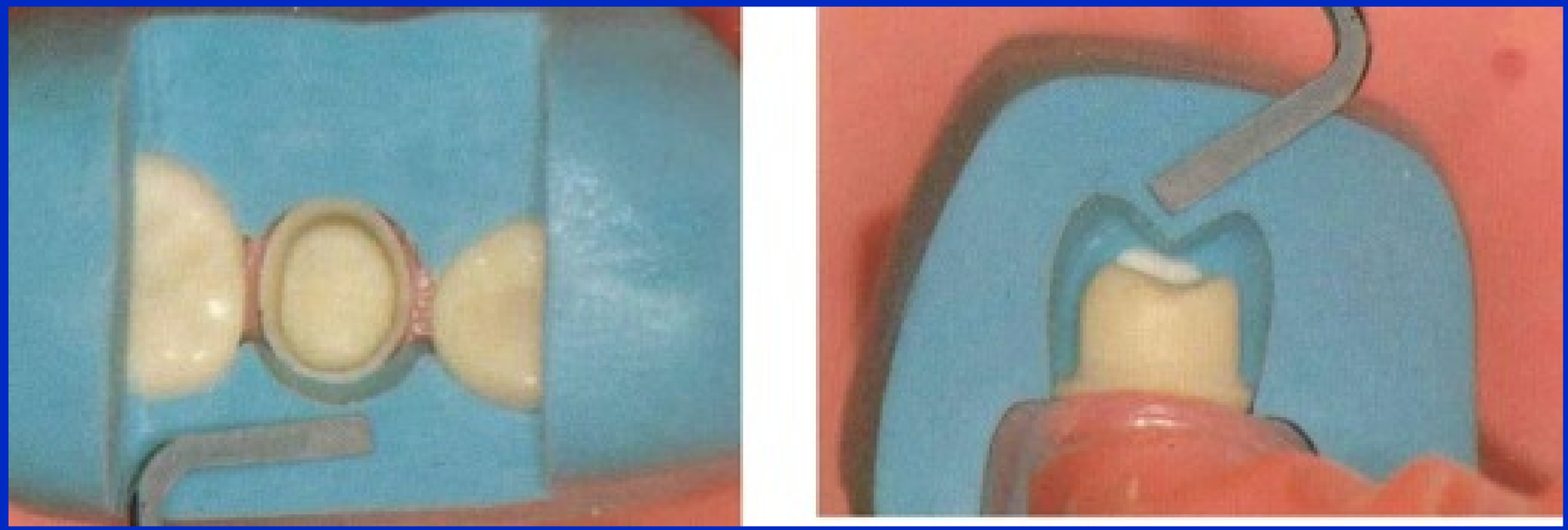
- Check the occlusal reduction on a 1.5mm of thickness leaf.

- Make depth orientation grooves on the facial and lingual surfaces to ensure that adequate reduction of tooth with a minimum thickness of 1mm gingival finish line.
- Remove the remaining tooth structure between the grooves with the help of large round end tapered diamond so the shoulder with a rounded internal line angle can be formed.

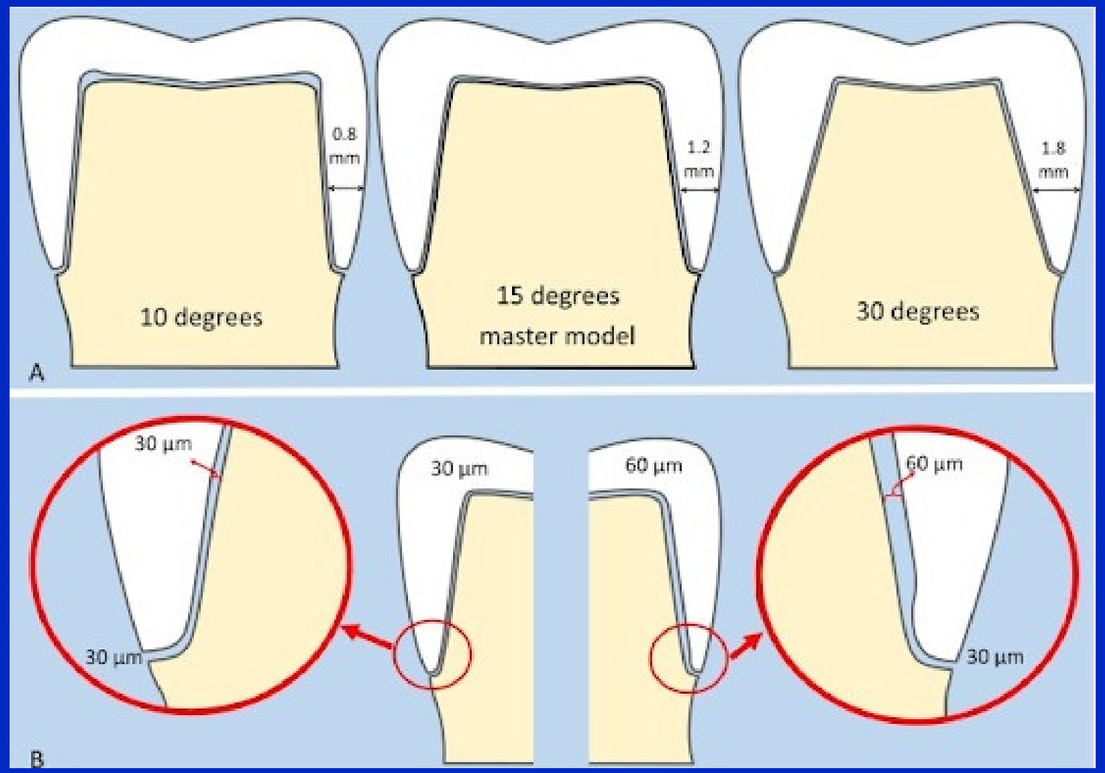
- Now use this short needle diamond, to begin with the proximal reduction.
- As more space is created the needle diamond can be brushed across to produce more reduction.

- Use round end tapered diamond point to blend the proximal axial reduction and shoulder of facial and lingual surfaces.
- To finish off the preparation, use the fine grit tapered bur to smooth and blend the totality of the crown preparation, rounding off any remaining sharp line angles.
- The circumferential shoulder margin is defined and finalized with the flat-end tapered diamond bur and the end-cutting diamond bur. The buccal aspect should be at the gingival margin, while the lingual aspect may be 0.5 mm supragingival.

- Now use the horizontal and sagittal index to reveal the amount of facial, lingual and occlusal reduction.



- The removal of all morphologic forms of the tooth is a radical treatment and restoring it properly can be difficult.
- The full veneer crown is a restoration that replaces lost tooth structure and imparts some measure of structural support to the tooth.
- Hence, one must be able to judge correctly the type of restoration required for each tooth and try to follow the guidelines for the respective tooth preparation.



VARIOUS TOOTH PREPARATIONS

Metal or All-Zirconia

PFM

All-Ceramic

REFERENCES

- Shillingburg (1981) Fundamentals of Fixed Prosthodontics.
- C.J Goodacre- designing tooth preparation for optimal success.

Thank You

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